

## WHAT IS CLAIMED IS:

1. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

5 a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis in the molten salt of the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride containing  $\text{TiCl}_4$  into said molten salt in order to cause the metallic chloride containing  $\text{TiCl}_4$  to react with Ca generated on a cathode electrode side by the  
10 electrolysis; and

a Ti separation step of separating said Ti or Ti alloys from the molten salt inside the reactor cell or outside the reactor cell,

wherein said reactor cell is provided with a membrane which partitions an inside of the reactor cell into an anode electrode side and the cathode  
15 electrode side, said membrane blocking the movement of Ca generated on the cathode electrode side in the reactor cell toward the anode electrode side while permitting the molten salt to flow in the reactor cell.

2. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

20 a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis using an electroconductive porous material as an cathode electrode in the molten salt of the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride  
25 containing  $\text{TiCl}_4$  into said molten salt through said cathode electrode in order to cause the metallic chloride containing  $\text{TiCl}_4$  to react with Ca generated on a cathode electrode side by the electrolysis; and

a Ti separation step of separating said Ti or Ti alloys from the molten salt inside the reactor cell or outside the reactor cell.

3. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis in the molten salt of the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride containing  $\text{TiCl}_4$  into said molten salt in order to cause the metallic chloride containing  $\text{TiCl}_4$  to react with Ca generated on a cathode electrode side by the electrolysis;

10 a Ti separation step of separating said Ti or Ti alloys from the molten salt inside the reactor cell or outside the reactor cell; and

a chlorination step of causing  $\text{Cl}_2$  to react with  $\text{TiO}_2$  to generate  $\text{TiCl}_4$ ,  $\text{Cl}_2$  being generated on an anode electrode side in association with said electrolysis,

wherein  $\text{TiCl}_4$  generated in the chlorination step is used for the Ti or Ti alloy generation reaction in said reactor cell.

15 4. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis in the molten salt of the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride containing  $\text{TiCl}_4$  into said molten salt in order to cause the metallic chloride containing  $\text{TiCl}_4$  to react with Ca generated on a cathode electrode side by the electrolysis; and

25 a Ti separation step of extracting Ti or Ti alloys generated in said reactor cell to an outside of said reactor cell along with the molten salt, and said Ti separation step of separating said Ti or Ti alloys from the molten salt outside the reactor cell.

5. The method for producing Ti or Ti alloys through reduction by Ca according to claim 4, wherein the molten salt separated from Ti or Ti alloys

outside said reactor cell is returned to said reactor cell.

6. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

5 a reduction electrolysis step in which a multi-system molten salt is held in a reactor cell to perform electrolysis in the molten salt of the reactor cell, the multi-system molten salt containing at least one of NaCl, KCl, LiCl, and CaF<sub>2</sub> in addition to CaCl<sub>2</sub>, Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride containing TiCl<sub>4</sub> into said molten salt in order to cause the metallic chloride containing  
10 TiCl<sub>4</sub> to react with Ca generated on a cathode electrode side by the electrolysis; and

a Ti separation step of separating said Ti or Ti alloys from the molten salt inside the reactor cell or outside the reactor cell.

7. The method for producing Ti or a Ti alloys through reduction by Ca  
15 according to claim 6, wherein said multi-system molten salt contains at least CaCl<sub>2</sub> and NaCl at a ratio in which a melting point of said multi-system molten salt becomes not more than 600 °C, and the mixed molten salt is held at temperatures of not more than 600 °C in said reduction electrolysis step.

8. The method for producing Ti or a Ti alloys through reduction by Ca  
20 according to claim 7, further comprising a Na separation step in which the molten salt is temporarily extracted to the outside of the reactor cell, the molten salt being used to generate Ti or Ti alloys in said reactor cell, and the molten salt is heated to temperatures of more than 600 °C to generate Na; and then said molten salt is returned to the inside of the reactor cell after the  
25 generated Na is separated and removed.

9. The method for producing Ti or Ti alloys through reduction by Ca according to claim 8, wherein said Na separation step is also used as said Ti separation step.

10. The method for producing Ti or Ti alloys through reduction by Ca

according to claim 8, wherein Na separated from the molten salt in said Na separation step is supplied to the reduction electrolysis step.

11. A method for producing Ti or Ti alloys through reduction by Ca, comprising:

5 a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis in the molten salt in the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and generating Ti or Ti alloys are generated in said molten salt by supplying a mixed gas containing  $\text{TiCl}_4$  and other metallic chloride into said molten salt in order to  
10 cause the mixed gas to react with Ca generated on a cathode electrode side by the electrolysis; and

a Ti separation step of separating said Ti or Ti alloys from the molten salt inside the reactor cell or outside the reactor cell.

12. A method for producing Ti or Ti alloys through reduction by Ca,  
15 comprising:

a reduction electrolysis step in which a molten salt is held in a reactor cell to perform electrolysis in the molten salt of the reactor cell, the molten salt containing  $\text{CaCl}_2$  while Ca being dissolved in the molten salt, and Ti or Ti alloys are generated in said molten salt by supplying a metallic chloride containing  
20  $\text{TiCl}_4$  into said molten salt in order to cause the metallic chloride containing  $\text{TiCl}_4$  to react with Ca generated on a cathode electrode side by the electrolysis, Ti or Ti alloys being formed in powder whose average particle size ranging from 0.5 to 50  $\mu\text{m}$ ; and

a Ti separation step of separating said Ti or Ti alloys from the molten salt  
25 inside the reactor cell or outside the reactor cell.